Each tentacle originates in a bulbous base with a distinct ocellus. No lithocysts are visible on the margin. The velum is of moderate width.

The manubrium forms a small projection from the summit of the umbrella, and terminates in four rather indistinct lips. From the base of the manubrium three rather wide offsets are sent off at equal intervals into the walls of the umbrella. These gradually contract in diameter, and then, as three narrow tubes of uniform diameter, run towards the margin, where they open into the circular canal. The symmetry of the radiating canals is confined to these three primary trunks. From their wide proximal ends each sends off branches, some of which may be traced to the margin where, like the three primary canals, they enter the circular canal, while others can be followed for various distances in the umbrella walls, in which they terminate by blind extremities without ever reaching the margin. These branches are very irregular in the number sent off from each primary canal, as well as in their length and directions.

The generative elements are formed in oval sporosacs developed one on each of the three primary canals at the spot where the wider base passes into its narrower continuation. The ova may be seen within them in various stages of development; they increase considerably in size before the commencement of segmentation, always showing up to that period a large and distinct germinal vesicle with germinal spot and with a distinct nucleolus in the interior of the germinal spot. The development of the ovum proceeds within the sporosac to the segmentation of the vitellus and the formation of the planula, which now breaks through the outer walls of the sporosac and remains for some time adhering to their external surface. The planula differs remarkably from the typical hydroid planula. It remains of a nearly spherical form, never acquiring cilia, and possesses little or no power of locomotion. The gastric cavity, however, is fully formed. The author was unable to follow the ova in their further development.

The little medusa now described, departs in several important points from the typical hydroid medusa. From this it differs in the ternary disposition of the primary radiating canals, and in the irregular non-symmetrical arrangement of those which are subsequently formed. Among the very many specimens examined, the author never found any in which the canals had become regular in their disposition, even in those which had discharged the contents of their sporosacs, and had evidently attained the term of their existence. It differs also from the typical medusa in the form and non-ciliated condition of the planula; and still further in the fact that while the generative elements are borne on sporosacs, developed on the radiating canals, the marginal bodies are ocelli and not lithocyst.

4.—*Circe invertens* (nov. spec.)

Among the hydroid medusæ captured in the towing-net, were two or three specimens of a species referable to the genus *Circe* of Mertens. It measures about half-an-inch in its vertical diameter, and about a quarter of an inch transversely. It is cylindrical from its base upwards, for about two-thirds of its height, and then contracts abruptly, and arches dome-like towards the truncated summit, which is surmounted by a solid cone of the gelatinous umbrella substance. From the summit of the umbrella-cavity, a solid somewhat fusiform extension of the roof hangs down in the axis of its cavity for about two-thirds of its depth, and at its free end carries the manubrium, which extends nearly to the codonostome. The margin of the umbrella carried eighty very short and but slightly extensile tentacles, which were connected at their bases by a very narrow membraneous extension of the margin, with rather irregular free-edge. Lithocysts are situated at irregular intervals upon the margin. There are about sixteen of them; they consist each of a minute spherical vesicle with a single large spherical concretion. There are no ocelli. There is a moderately wide velum.

The radiating canals are eight in number. They spring from the base of the manubrium, run up the sides of the solid process which hangs from the summit of the umbrella; pass from this to the walls of the umbrella, and then run down towards the margin in order to open into the circular canal.

The generative elements are borne in pendent sporosacs, which spring from the radiating canals close to the summit of the umbrella cavity.

The motion of the medusa takes place by means of sudden jerks, reminding us of the way in which certain Diphydæ dart through the water.

The medusa possesses also a very singular habit of partial inversion. This takes place along the line which separates the dome-like portion of the umbrella cavity from the lower cylindrical portion, and consists in the withdrawal of this dome-like summit and the lower portion of the cavity. When thus inverted the little animal presents a drum-shaped form, with the manubrium hanging far out of the codonostome.

Alexander Agassiz considers the genus *Circe*, of Mertens, as synonymous with *Trachynema* Gegenbaur, and points out that the name of *Circe* had been already used for a genus of mollusca. He further removes it from among the true hydroid medusæ, and regarding it as closely allied to the *Æginidæ*, places it along with those in the *Haplostomeæ* Agassiz, a sub-order of the *Discophora*.

The author, however, could not see sufficient grounds for the removal of Mertens' genus from the true *Hydroida*, with which the medusa now described agrees in all essential points, including the form and disposition of the gastro-vascular and generative systems and the structure of the marginal lithocysts. Neither could he agree with Alexander Agassiz in identifying it with *Trachynema*. The greatly developed solid peduncle by which the manubrium in *Circe* is suspended from the summit of the umbrella-cavity in a way, however, which has its parallel in *Tima* among others, is of itself a character of generic importance by which *Circe* must be kept apart from *Trachynema*. It is true that Gegenbaur's *Trachynema* has the character of a young form, and until we have further evidence of its adult state its affinities cannot be regarded as established.

Gegenbaur believes that he has established the direct development of *Trachynema* from the egg without the intervention of a hydriform trophosome, but unfortunately we have no data by which to compare in this respect *Circe* with *Trachynema*.

It must be admitted too that in the imperfect contractility of the marginal tentacles and in the somewhat greater firmness of the umbrella walls the little medusa described in the present communication possesses characters which look towards the *Æginidæ*, but these are by no means sufficiently strong to justify its separation from the ordinary hydroid medusæ.

5.—*Tomopteris*

A few young specimens of this beautiful little worm were obtained, and the author was enabled to confirm the statements of Grube and of Keferstein, who describe in it a double ventral nerve chord, though other observers have failed to discover this part of the nervous system and throw doubt upon its existence. In adult specimens examined some years previously by the author no ventral chord could be detected.

The ventral portion of the nervous system consists of two flat ribbon-shaped chords which are given off from the inferior side of the nerve ring which surrounds the pharynx just behind the mouth. These run parallel to one another, separated by a narrow interval; they lie on the ventral walls of the animal, and may be traced through the narrow tail-like termination of the body as far as its extremity. They present no ganglionic swellings, but opposite to every pair of feet each sends off a filament which passes to the foot of its own side in which it is distributed.

Dr. Anton Dohrn has just informed the author that he too had distinctly seen the ventral chord of *Tomopteris*.

SCIENTIFIC SERIALS

AMONGST the papers in the October and November numbers of the *American Naturalist*, are included Dr. J. L. Smith's Address to the American Association for the Advancement of Science, on Science in America and Modern Methods of Science.—Mr. R. Ridgway describes some new forms of American Birds, which he considers as geographical races, and not distinct species. Included are *Catherpes mexicanus*, var. *conspersus*; *Helminthophaga celata*, var. *lutescens*; *Dendroica vieillotii*, var. *bryanti*; *D. dominica*, var. *albilora*; *D. graciæ*, var. *decora*; *Myiodioctes pusillus*, var. *pileolata* (Pallas), and *Collurio ludovicianus*, var. *robustus* (Baird), which are described and followed by a synopsis of the genera of *Certhiola*, *Junco*, and *Cardinalis*.—Prof. C. A. Riley has a paper on the Oviposition of the Yucca Moth, in which he shows that the female conveys her eggs into the young fruit by a lateral puncture. The Structure and Growth of Domesticated Animals, forms the subject of a popular lecture by Prof. Agassiz, which is followed by one on Staurolite

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Crystals and Green Mountain Gneisses of the Silurian Age, by Prof. Dana.—The Rev. D. T. Hill gives instances of intelligence in *Bufo americanus*.—Mr. G. W. Morehouse analyses the structure of the scales of *Lepisma saccharina*.—Mr. D. Scott gives a popular explanation of the differences between the two genera of North American Goatsuckers, the Whippoorwills (*Antrostomus*), and the Nighthawks (*Chordeiles*), which is followed by a short note from Mr. Packard, jun., on the Embryology of Limulus, with remarks on its affinities. His results are confirmatory of those of M. Alphonse Milne-Edwards.

The fourth and concluding part of vol. xxviii. of the *Transactions of the Linnean Society*, is chiefly occupied by a supplementary paper by the Rev. O. P. Cambridge, on New and Rare British Spiders; but also contains some short papers of importance.—Prof. Oliver describes a new genus of Begoniaceæ from New Granada, under the name of *Begoniella*, a monotypic genus of great interest as respects the geographical distribution of the order; and three new genera of Malayan plants from the herbarium of Dr. Maingay—*Pteleocarpa* and *Ctenolophon* (Olacineæ), and *Maingaya* (Hamamelideæ).—Dr. M'Nab publishes his important paper on the Development of the flowers of *Welwitschia mirabilis*. Dr. M'Nab considers that in the male flowers of this very remarkable plant we have a very close approach to the Angiosperms, the axis of the flower ending in a mass of tissue which, in the female flower, is the terminal ovule; while, in the female flower, we have the truly gymnospermous condition, there being no carpels, but a terminal ovule, the modified end of the axis of the flower, with a single ovular integument, the pollen grains being applied directly to the naked nucleus.

SOCIETIES AND ACADEMIES

Royal Society, Nov. 20.—"Note on the Electrical Phenomena which accompany irritation of the leaf of *Dionæa muscipula*," by Dr. J. Burdon Sanderson, F.R.S.

1. When the opposite ends of a living leaf of *Dionæa* are placed on non-polarisable electrodes in metallic connection with each other, and a Thomson's reflecting galvanometer of high resistance is introduced into the circuit thus formed, a deflection is observed which indicates the existence of a current from the proximal to the distal end of the leaf. This current I call the *normal leaf-current*. If, instead of the leaf, the leaf-stalk is placed on the electrodes (the leaf remaining united to it) in such a way that the extreme end of the stalk rests on one electrode and a part of the stalk at a certain distance from the leaf on the other, a current is indicated which is opposed to that in the leaf. This I call the *stalk-current*. To demonstrate these two currents, it is not necessary to expose any cut surface to the electrodes.

2. In a leaf with the petiole attached, the strength of the current is determined by the length of the petiole cut off with the leaf, in such a way that the shorter the petiole the greater is the deflection. Thus in a leaf with a petiole an inch long I observed a deflection of 40. I then cut off half, then half the remainder, and so on. After these successive amputations, the deflections were respectively 50, 65, 90, 120. If in this experiment, instead of completely severing the leaf at each time, it is merely all but divided with a sharp knife, the cut surfaces remaining in accurate apposition, the result is exactly the same as if the severance were complete; no further effect is obtained on separating the parts.

3. *Effect of constant current directed through the petiole on the leaf-current.*—If the leaf is placed on the galvanometer electrodes as before, and the petiole introduced into the circuit of a small Daniell, a commutator being interposed, it is found that on directing the battery-current down the petiole (*i.e.*, *from* the leaf), the normal deflection is increased; on directing the current *towards* the leaf, the deflection is diminished.

4. *Negative variation.*—*a.* If, the leaf being so placed on the electrodes that the normal leaf-current is indicated by a deflection *leftwards*, a fly is allowed to creep into it, it is observed that the moment the fly reaches the interior (so as to touch the sensitive hairs on the upper surface of the lamina), the needle swings to the right, the leaf at the same time closing on the fly.

b. The fly having been caught does not remain quiet in the leaf; each time it moves the needle again swings to the right, always coming to rest in a position somewhat farther to the left than before, and then slowly resuming its previous position.

c. The same series of phenomena present themselves if the sensitive hairs of a still expanded leaf are touched with a camel-hair pencil.

d. If the closed leaf is gently pinched with a pair of forceps with cork points, the effect is the same.

e. If the leaf-stalk is placed on the electrodes, as before, with the leaf attached to it, the deflection of the needle due to the stalk-current is *increased* whenever the leaf is irritated in any of the ways above described.

f. If half the lamina is cut off and the remainder placed on the electrodes, and that part of the concave surface at which the sensitive hairs are situated is touched with a camel-hair pencil, the needle swings to the right as before.

g. If, the open leaf having been placed on the galvanometer electrodes as in *a*, one of the concave surfaces is pierced with a pair of pointed platinum electrodes in connection with the opposite ends of the secondary coil of a Du Bois-Reymond's induction apparatus, it is observed that each time that the secondary circuit is closed, the needle swings to the right, at once resuming its former position in the same manner as after mechanical irritation. No difference in the effect is observable when the direction of the induced current is reversed. The observation may be repeated any number of times, *but no effect is produced unless an interval of from ten to twenty seconds has elapsed since the preceding irritation.*

h. If the part of the concave surface of the leaf which is nearest the petiole is excited, whether electrically or mechanically, the swing to the right (negative variation) is always preceded by a momentary jerk of the needle to the left, *i.e.* in the direction of the deflection due to the normal leaf-current; if any other part of the concave surface is irritated, this does not take place.

i. Whether the leaf is excited mechanically or electrically, an interval of from a quarter to a third of a second intervenes between the act of irritation and the negative variation.

"On the Algebraical Analogues of Logical Relations," by Alexander J. Ellis, F.R.S.

The object of this paper is to examine the "mathematical theory of logic," thus laid down by Dr. George Boole in his "Laws of Thought," p. 37:—"Let us conceive of an Algebra in which the symbols x, y, z, &c. admit indifferently of the values 0 and 1, and of these values alone. The laws, the axioms, and the processes of such an algebra will be identical in their whole extent with the laws, the axioms, and the processes of an Algebra or Logic. Difference of interpretation will alone divide them." For this purpose, first the laws of such an algebra have been investigated independently of logic, and secondly the laws of primary and secondary logical propositions as laid down by Dr. Boole, have been developed in an algebraical form, and compared with the former. The main results presumed to be established are:—

1. That there is a fundamental difference between such an algebra and logic, inasmuch as the algebra admits of only *two* phases, 0 and 1, and logic admits of *three* phases, namely, not only *none* and *all*, corresponding to 0 and 1, but also *some*, "which, though it may include in its meaning *all*, does not include *none*" (*ibid*, p. 124), and hence has no analogue in such an algebra; that is, an algebra of 0 and 1 can correspond only to a logic of *none* and *all*.

2. That, notwithstanding this difference, there are certain formal relations of equations which allow the algebra of 0 and 1 to be used as an *algorithm* for the purpose of arriving at certain logical forms, which, however, have then to be interpreted on a basis which has not even any analogy to the algebraical.

3. That the introduction of this algorithm introduces theoretical difficulties, adds to the amount of work, and is entirely unnecessary even for the purposes of the theory of probabilities founded upon it by Dr. Boole.

Mathematical Society, Nov. 13.—Prof. Cayley, and subsequently Prof. Sylvester, in the chair.—The following gentlemen have been elected officers of the new council:—President, Dr. Hirst; Vice-Presidents, Prof. Cayley, and Messrs. Spottiswoode and Sylvester. The retiring members were Prof. Crofton and Mr. J. Stirling, in whose room Mr. Sylvester and Lord Rayleigh were elected.—Mr. Sylvester then gave a description of a new instrument for converting circular into general rectilinear motion, and into motion in conics and other plane curves. (A brief sketch of the historical aspect of the communication, from the pen of Mr. Sylvester, forms the subject of a paragraph in NATURE of Nov. 13.) Several instruments were placed on the table for inspection.—Mr. W. Marsham Adams

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